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Main office: Rubna 716/24  
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**Zakladatel**  
*Nemoros*  
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*The East European Center  
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*Východoevropské centrum  
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## **TECHNICAL SCIENCES**

### **ADAPTATION OF THE MAPLE SYSTEM FOR IMPROVEMENT THE EFFICIENCY OF THE STUDENTS' INDIVIDUAL WORK AT THE STUDY OF THE TOPIC THE DIFFERENTIAL EQUATIONS SYSTEM**

*Yaroslav Krupskyy, Candidate of Pedagogical Sciences,*

*Vinnitsa National Technical University,*

*Olesya Yashchuk, Assistant,*

*Kyiv National Aviation University,*

*Olga Polonets, Assistant,*

*National Pirogov Memorial Medical University*

**Annotation.** *The concept of adaptation of the Maple system of computer mathematics to the study of higher mathematics topic "Differential equations system" is offered in order to master students' material more effectively. The use of the training simulator activates the educational and cognitive activity of students.*

**Key words:** *the system of computer mathematics, Maple-training simulators, higher mathematics, the independent work of the student.*

One of the conditions for improving mathematical education in the technical university is the active use of modern information technology, as well as systems of computer mathematics (SCM).

After analyzing the work of M. I. Zhaldak [1, 3], C. A. Rakov [11, 12], S. O. Semerikov [13], Yu. V. Trius [16, 17, 18], O. V. Spivakovsky [14], O. M. Spirin [15] one can identify the tendencies of using IT in education, as well as in these works, attention is drawn to the problems of forming skills of students' individual work using IT.

While studying higher mathematics students use SCM to provide visualization, graphical interpretation, mathematical modeling of processes, conduct large calculations, and it also provides the opportunity to use SCM as a means for students' individual work.

To organize a systematic, individual and systematic process of studying in a high school, optimization of the educational process is required, which should combine traditional methods and new forms of learning using information technology. These technologies are implemented at all stages: the study of the theoretical course at lectures - a combination of lecturers, manuals and information computer technology (ICT); conducting of practical classes and individual work of a student - solving individual tasks using algorithms for solving problems with comments and examples and their computer visualization; making calculation and graphic works - application of automated complexes to solving research and creative tasks.

Implementation of educational innovative technologies in higher education is always relevant. Problems of using ICT as well as systems of computer algebra are highlighted in the works of O. B. Zhiltsov [4], M. I. Zhaldak [2], V. I. Klochka [5], N. V. Morse [10]. These works indicate the search for the necessary methods to increase the efficiency of the educational process and the coefficient of usefulness of the "student - teacher" system. The need to combine traditional teaching methods, which are mostly explanatory, with new forms of learning, including the use of modern multimedia technologies, is dictated by the limited time of material mastery, in particular higher mathematics, poor student educational and ineffective organization of the educational process.

Optimization of the educational process with the use of modern information technologies can be achieved by combining verbal and visual presentation of the material, individual work at all stages of obtaining knowledge and skills and organization of individual and systematic training.

In the organization of the educational process in studying the course "Higher Mathematics" is used a broad set of teaching aids, which requires the use of a variety of methods and tools for managing the cognitive activity of each student at different levels of learning knowledge and skills development.

1. Lecture course is one of the main forms of knowledge transfer and is a combination of the presentation of theoretical material by the lecturer and the use of information technology in the audience.

2. Practical classes are focused on teaching methods for solving typical problems in higher mathematics.

Practical classes are a combination of: individual tasks, - algorithms for solving problems from all sections of practical classes with comments and examples illustrating their use, which allow to study methods for solving problems with the student's direct participation in logical considerations, the construction of variants of drawings, the choice of paths solution;

3. Typical student calculations are one of the forms of solving students' problems of higher complexity.

4. Student's individual work. To increase the CPC, the student must realize the need for new knowledge and skills. To implement and help the student in the CPC, it is advisable to use the training maple simulators (NMT) [6, 7, 8, 9] which provide the opportunity to gradually get the course of the task solution. In addition, the use of NMT stimulates the cognitive activity of students, contributing to the intellectual development of the individual. The availability of NMTs will enable students to test their abilities and skills or, in the event of difficulties, the program will tell you the next step.

According to O.V. Spivakovsky generating programs are intended for presentation sets of tasks of a certain type from a given topic to the students. Their use provides the opportunity to perform control or individual work in the classroom, providing each student with a specific task that corresponds to his individual abilities [14]. Therefore, for the selection of tasks for practical work on the topic of the system of differential equations, the generator of higher mathematics tasks on the topic of the system of

differential equations was developed, which gives the teacher the opportunity to provide each student with individual tasks (Fig. 1) in a short time, to the teacher it is enough to specify the required number examples, as well as the range of coefficients. In addition to the task generator itself, the author's NMT, at the choice of the teacher, has the ability to insert an answer to each task (Figure 2). The work of the generator is directed in such a way that during the calculations there are no complicated irrational coefficients in finding solutions.

To improve the efficiency of the students' individual work during the study of the topic of the differential equations system was developed the educational Maple simulator. Let's consider a brief description of the developed NMT on the topic of differential equations and the results of work on solving typical problems of higher mathematics. The procedure simulator "mysistemdifur (7, -5, 5, -3);" step by step is solving the system of differential equations by the method of exclusion (Figure 4). It is enough for the student to perform the author procedure "mysistemdifur (\*, \*, \*, \*);", where instead of the asterisks it is necessary to insert the coefficients of the task. The first two values correspond to the coefficients of the first equation for  $x$  and  $y$  respectively, and the second two for the other equation. The purpose of creating this simulator is to ensure a high level of higher mathematics education, as well as to reduce the routine assignment on the teacher. In the presence of the simulator, the student's individual work becomes more effective. The role of the teacher is to provide an advisory assistance. Also, the student has the opportunity to independently solve the examples, and to use the simulator as a check of their steps and, in case of an error, without the teacher's assistance, to localize them. And also change the condition of the example and observe how the solution changes.

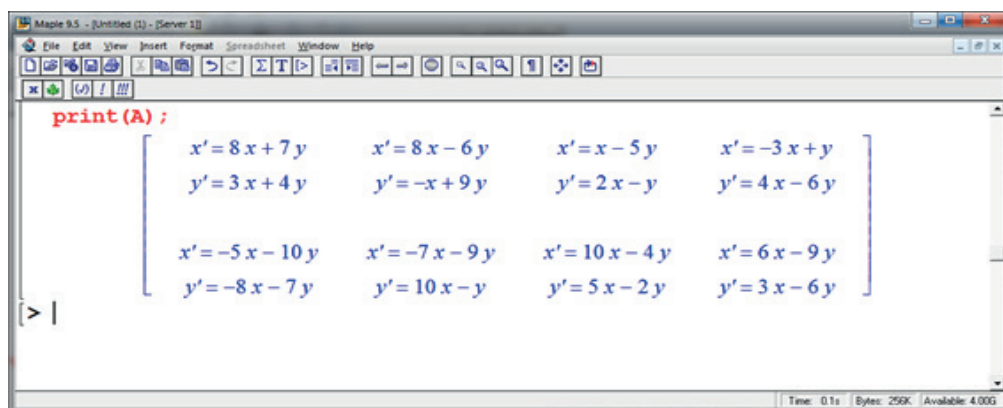


Fig. 1. Generation of individual tasks.

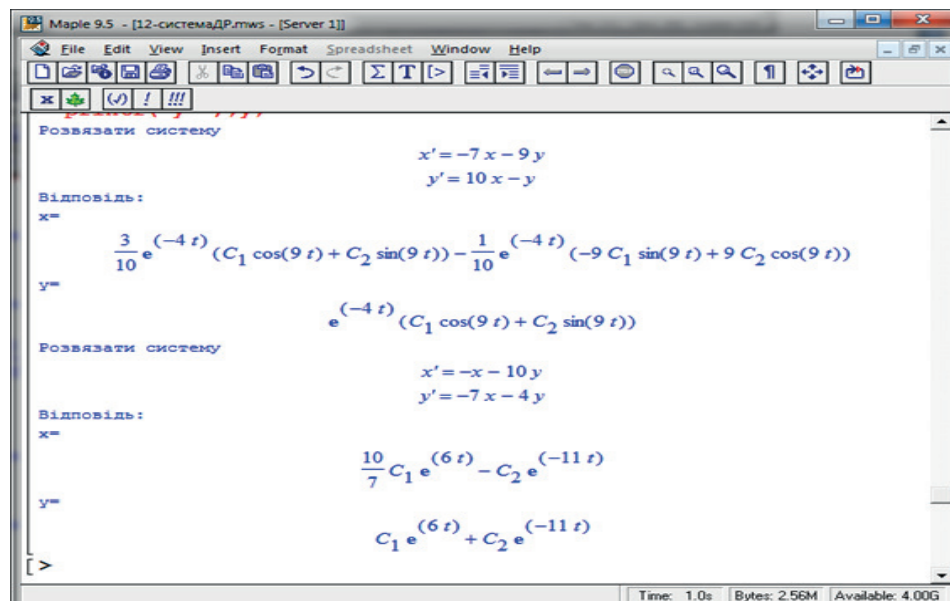


Fig. 2. Result of generation of individual tasks with answers.

The use of a training simulator creates conditions for studying or familiarizing students with the topic "Differential equations systems". At a practical class, and even more, in the typical calculation, other methods may be considered (Figure 3.).

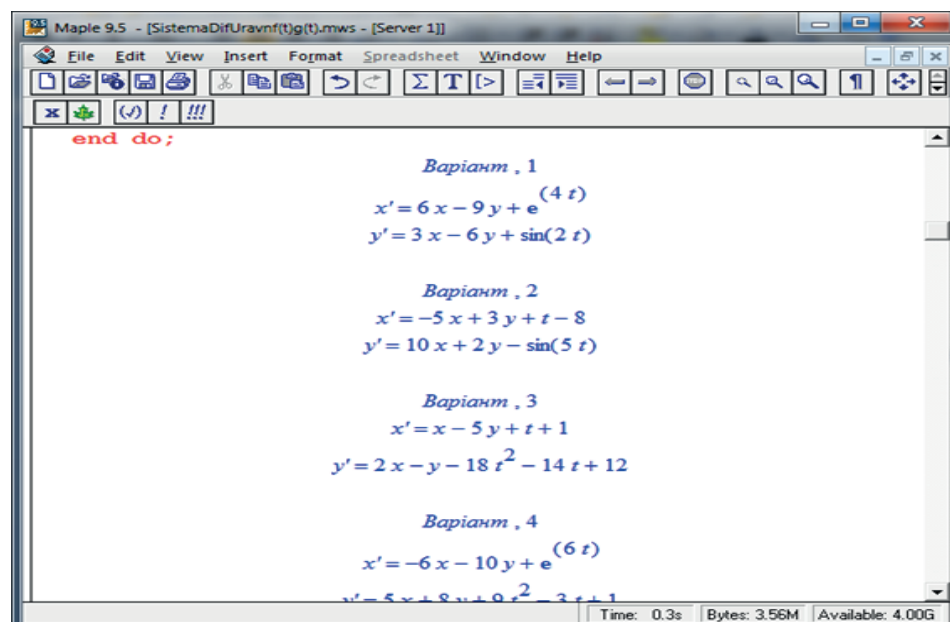


Fig. 3. Result of generation of individual tasks.

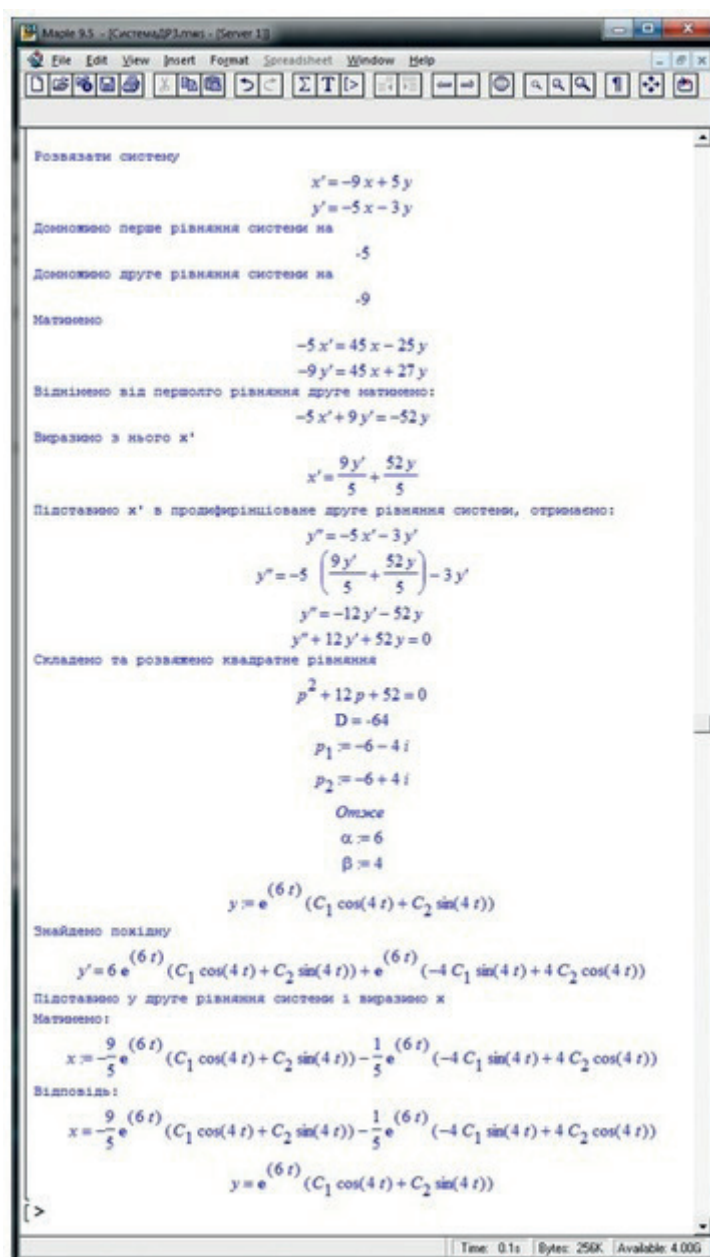


Fig. 4. The work of NMT on the differential equations system.

**Conclusions.** Thus, it can be seen that the use of ICT tools is one of the ways to optimize the learning process by creating conditions for organizing active individual learning activities, for a differentiated and individualized approach to student learning. Researches show that the use of SCM in today's conditions significantly changes the role



and functions of teachers and students, greatly affects all components of the educational process: the nature, place and methods change themselves.

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